

A High Efficiency 30 K Cryocooler with Low Temperature Heat Sink, Phase I

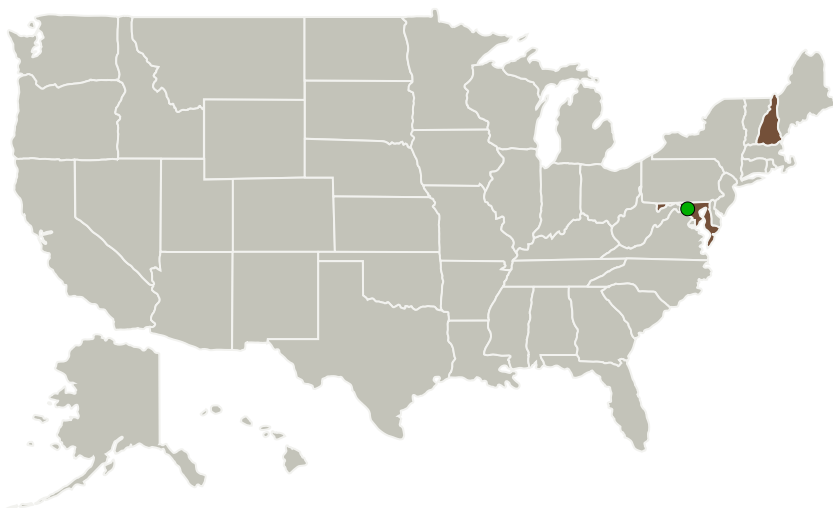
Completed Technology Project (2015 - 2015)



Project Introduction

Future NASA planetary science missions will incorporate detectors, sensors, shields, and telescopes that must be cooled to cryogenic temperatures. These missions have very limited access to solar power and therefore reducing the cryocooling system power is more critical than for earth-orbiting satellites. On this program, Creare proposes to develop and demonstrate an innovative Stirling cryocooler that efficiently produces refrigeration at 30 K and rejects heat at about 150 K. A key component of the proposed cryocooler, its regenerator, will be optimized on this program to obtain high efficiency over this operating temperature range. The innovation is a regenerator fabricated by a unique process to enhance its heat capacity near its target cooling temperature and therefore increase the overall thermal efficiency of the cryocooler. The proposed cryocooler is built on technologies developed for commercial Stirling cryocoolers that are extremely compact and efficient while rejecting heat at 300 K. In Phase I, we will develop the regenerator fabrication process, measure the performance of a subscale regenerator under prototypical conditions, and optimize the cooler design for optimum performance. In Phase II, we will fabricate full-size regenerators, characterize their performance, integrate a regenerator into a Stirling cooler, and optimize the cryocooler operating parameters to maximize its performance. At the end of Phase II, we will deliver a cryocooler to NASA for further performance characterization.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland	New Hampshire
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Project Transitions

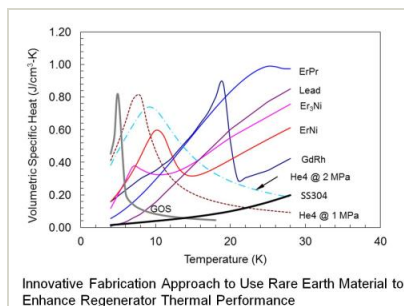
▶ **June 2015:** Project Start

✓ **December 2015:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138615>)

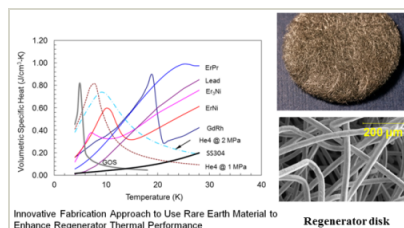
Images



Briefing Chart

A High Efficiency 30 K Cryocooler with Low Temperature Heat Sink Briefing Chart

(<https://techport.nasa.gov/image/134030>)



Final Summary Chart Image

A High Efficiency 30 K Cryocooler with Low Temperature Heat Sink, Phase I Project Image

(<https://techport.nasa.gov/image/125997>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Creare LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Weibo Chen

Co-Investigator:

Weibo Chen

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Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System